PROGRAM: Harvesting and Conversion Program

PROJECT #: H.07

PROJECT TITLE: Present Utilization and Outlook of BC Hem-fir for Composite Products – Literature Review

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Abstract

During the 2007/2008 fiscal year, a literature survey was conducted on approximately 90 papers and reports collected from various sources. The growth traits, wood properties, machining and processing characteristics, and historical end uses of Hemlock and Amabilis (Hem-fir) resource were summarized. Some technical issues in Hem-fir lumber/veneer processing were addressed. Future research needs for Hem-fir used as composite products were identified in the areas of resource assessment, veneer processing and product scenarios.

Currently, industrial/structural uses of Hem-fir in BC are primarily for home and commercial building construction as structural lumber and plywood, specialized wood products, as well as pulp and newsprint. End products of Hem-fir include framing lumber, joinery, windows, doors, staircases, cabinet doors, ladders, floors, roof decking, railway ties, boxes, interior woodworking and finishes, veneer/plywood, and laminating stock or Glulam.

Several plywood mills in BC use segregated Hemlock and Amabilis fir to manufacture sheathing grade plywood and/or overlaid plywood. Specialty plywood forms are also made from Hemlock veneer since Hemlock is stronger and denser than Amabilis fir. According to our industry survey, the overall recovery of Hem-fir is about 10% lower than that of coastal Douglas fir. The drying productivity is also significantly lower for Hem-fir, about 70% of that of coastal Douglas fir. On the other hand, previous pilot plant studies at FPInnovations- Forintek have demonstrated that the second growth Hem-fir is peelable and good for manufacturing plywood/LVL. Particularly, Hemlock is comparable to Interior Douglas-fir for making structural LVL. However, no BC mills are currently selling or using Hemlock veneers for LVL manufacturing.

The following areas of research are still lacking: 1) the implications of the resource change from an old-growth to a predominantly second growth on veneer peeling, sorting and drying, especially the effect of green veneer MC sorting and drying parameters on drying productivity and quality, and 2) characterization / benchmarking of Hemlock and Amabilis fir veneers and resulting plywood/LVL products from different stands/locations. While veneer recovery is mainly controlled by log diameter, veneer stiffness properties are affected by growth rate. Slow growing stand produces stronger veneer, which is more suitable for producing LVL product. Fast growing stand produces bigger tree, but more knotty and relatively lower density, which would be more suitable for plywood production.

As far as resource assessment is concerned, it is desirable to increase value recovery from Hem-fir resource, both from crown harvest and private land harvest, and from different stands/locations and/or sivilcultural practices. Hem-fir segregation should be first performed in the logging site or in the log yard. Log acoustic sorting could be effectively used to evaluate the stiffness of Hemlock logs and then segregate them for different end uses, which could include plywood/LVL, lumber, Glulam, OSB/MDF, pulp and paper and so on.

From the view point of veneer processing, optimum conditioning and peeling parameters (including knife angles) should be developed for Hemlock and Amabilis fir, respectively. These parameters should be specific to stands/locations with known growth patterns. Green veneer MC sorting should be performed to segregate green Hemlock veneers for more uniform drying. Green veneer treatment with chemicals such as borax could also be applied to reduce veneer overdrying. Optimum drying temperature and humidity settings should be further developed to balance dry veneer MC uniformity, quality and productivity.

To increase the value recovery from Hem-fir resource, the best product scenario should be determined for composite products. The properties of Hemlock veneers from different stands/growth rates should be benchmarked against common softwood species for market access and product certification. Clear straight grain Hem-fir should be peeled or sliced for decorative laminated products. On-line stress grading should be used to segregate dry Hemlock veneers for high grade LVL and plywood products. Such grading should be based on veneer MOE instead of ultrasonic propagation time (UPT) to achieve higher grade outturn. Based on the market requirements of end LVL/plywood products, the optimum MOE breakpoints should be established to grade Hemlock veneers. As demonstrated, Hemlock could be successfully mixed with other species such as mountain pine beetle (MPB)-attacked lodgepole pine for making high stiffness LVL with no cosmetic concerns, reduced costs, increased dimensional stability, improved shear and bending performance. A production trial on this mixed species LVL is required.

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